IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

Pavel G. Polykin, et al.

Application No. 10/033,549

Filed: December 27, 2001

For: OPTICAL SPECTRAL POWER MONITORS EMPLOYING TIME-DIVISION-MULTIPLEXING DETECTION SCHEMES

Group Art Unit: 2874

Examiner: Stahl, M.

APPEAL BRIEF

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Kathleen LaBrie
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Dear Sir/Madam:

This is a brief for an appeal from a Final Office Action dated April 29, 2005, and from a Notice of Appeal that was filed on July 1, 2005. Three copies of this appeal brief are enclosed. This brief is being filed with a petition for a one month extension of time.

Real Party in Interest

The real party of interest is Capella Photonics, Inc., pursuant to the assignment executed on November 28, 2001, and recorded on December 27, 2001 at reel 012421 and frames 0148-0151.

Related Appeals and Interferences

There are no related appeals or interferences.

Status of Claims

Claims 1-38 were originally presented on the filing of the application. Claims 30, 33-34, and 37-38 were cancelled, and claims 1-29, 31-32, and 35-36 remain pending. This is an appeal of the rejected Claims 1-29, 31-32, and 35-36.

Status of Amendments

No amendments were filed subsequent to final rejection.

Summary of Claimed Subject Matter

The present invention provides an apparatus and method for optical spectral power monitoring that is capable of concurrent and time-division-multiplexed detection. (Pending Application at page 2, lines 11-12).

One embodiment of the invention, according to Claim 1, is a spectral power monitoring apparatus, and comprises an input port providing a multi-wavelength optical signal. (Id. at page 6, lines 26-27). The spectral power monitoring apparatus additionally comprises a wavelength

disperser that separates by wavelength the multi-wavelength optical signal into multiple spectral channels having a predetermined relative arrangement. (Id. at page 6, lines 26-30). The arrangement of spectral channels is configured to correspond with an array of beam-manipulating elements. (Id. at page 7, lines 1-5). The apparatus further comprises an array of optical detectors including a plurality of optical detectors each corresponding to a unique one of the spectral channels. The array of beam-manipulating elements is capable of directing the spectral channels into the corresponding optical detectors in the optical detector array. (Id. at page 8, lines 4-10). Furthermore, the array of beam-manipulating elements is capable of directing the spectral channels into the array of optical detectors concurrently and is capable of directing spectral channels into the array of optical detectors in a time-division-multiplexed sequence. (Id. at page 8, lines 12-25).

In another embodiment of the invention, according to Claim 18, a spectral monitoring apparatus comprises an input port, providing a multi-wavelength optical signal, a polarization separating element to decompose the multi-wavelength optical signal into a first and a second polarization component, and a polarization rotating element that rotates the polarization of the second polarization component by approximately 90 degrees. (Id. at page 10, lines 6-13, Figure 3). The apparatus further comprises a wavelength disperser that separates by wavelength the first and second polarization component into a first and second set of optical beams, respectively. (Id. at page 10, lines 13-16). The apparatus comprises a beam focuser that focuses the first and second sets of optical beams into corresponding focused spots. (Id. at page 10, lines 18-19). The apparatus additionally comprises an array of beam-manipulating elements positioned to correspond with the first and second sets of optical beams, and at least one array of optical detectors for monitoring power associated with the first and second polarization components.

The beam-manipulating elements in the beam-manipulating array are individually controllable, so as to be capable of directing some of the first and second set of optical beams into at least one array of optical detectors concurrently, and capable of directing some of the optical beams into the at least one array of optical detectors in a time-division-multiplexed sequence. (Id. at page 10, lines 26-31, and at page 11, lines 1-7).

In another embodiment of the invention, according to Claim 32, a method for optical spectral power monitoring comprises providing a multi-wavelength optical signal, separating by wavelength the multi-wavelength signal into multiple spectral channels, and selectively directing the spectral channels into an array of optical detectors such that some of the spectral channels are capable of being received by the optical detectors concurrently and some of the spectral channels are capable of being received by the optical detectors in a time-division-multiplexed sequence. (Id. at page 6, lines 26-31, at page 7, lines 1-6, and at page 8, lines 4-10).

In another embodiment of the invention, according to Claim 36, a method of optical spectral power monitoring comprises providing a multi-wavelength optical signal, decomposing the multi-wavelength signal into a first and second polarization component, rotating the polarization of the second polarization component by approximately 90 degrees, and separating by wavelength the first and second polarization component into a first and second set of optical beams, respectively. (Id. at page 10, lines 1-16). The method further comprises focusing the first and second set of optical beams into focused spots that impinge onto an array of beam-manipulating elements, and individually controlling each of the beam-manipulating elements such that some of the optical beams are capable of being directed into at least one array of optical detectors concurrently, and some of the optical beams are capable of being directed into the at least one array of optical detectors in a time-division-multiplexed sequence, whereby the array of

optical detectors monitors power associated with the first and second polarization components. (Id. at page 10, lines 16-30, at page 11, lines 1-3, and at page 8, lines 4-10).

Grounds of Rejection to be Reviewed on Appeal

The grounds of rejection to be reviewed on appeal are as follows:

(i) whether Claims 1-11, 32, and 35 are rendered unpatentable under 35 U.S.C. 103(a) over United States Patent Number 5,504,575 of Stafford ("Stafford") in view of United States Patent Number 5,483,335 of Tobias ("Tobias");

(ii) whether Claims 18-29, 31, and 36 are rendered unpatentable under 35 U.S.C. 103(a) over Stafford in view of Tobias, further in view of United States Patent Number 6,177,992 of Braun et al. ("Braun"); and

(iii) whether Claims 12-17 are rendered unpatentable under 35 U.S.C. 103(a) over Stafford in view of Tobias, further in view of United States Patent Number 3,090,278 of Saunderson ("Saunderson").

Argument

All independent claims 1, 18, 32, and 36 recite limitations relating to the use of an array of optical detectors in an optical apparatus, and both the capability of directing spectral channels or optical beams into the array of detectors concurrently and the capability of directing spectral channels or optical beams into the array of detectors in a time-division-multiplexed sequence. The Examiner asserts that an array of detectors disclosed in Tobias can be combined with Stafford to meet these limitations of the present invention. But there is no evidence supporting a motivation to combination of Tobias and Stafford. In fact, the references teach away from such a

combination. Furthermore, even if such a combination were made, it would not teach all limitations of the present invention.

A. Claims 1-11, 32, and 35 are Patentable over Stafford in View of Tobias

The Examiner rejected claims 1-11, 32 and 35 as unpatentable over Stafford in view of Tobias. Tobias was cited for its disclosure of multiple detectors, i.e., "array detectors". Namely, the Examiner asserted that it would be obvious to combine the array detectors disclosed in Tobias with the multiplexed system of Stafford to provide the claimed invention. Appellants respectfully assert that this proposed combination is improper and fails disclose all of the elements of the claimed invention. Thus, the proposed combination cannot render obvious any of the pending claims.

1. The Stafford And Tobias References

United States Patent Number 5,504,575 of Stafford discloses a spectrometer having a spatial light modulator (SLM). The apparatus taught in Stafford comprises a collimator 10 and dispersing element 16, upon which incident radiation 12 is dispersed into a linear wavelength spectrum 18 and subsequently transmitted or reflected by an SLM device 20 onto a *single* detector 28. (Stafford, col. 2, lines 55-67, and col. 3, lines 1-22).

United States Patent Number 5,483,335 of Tobias discloses an apparatus for multiplex spectroscopy. A typical embodiment of the Tobias invention comprises a collecting optic 31-s and chopper wheel 32-w, through which wavelength components of incident light provided by a source 31 are extracted. The extracted wavelength components are recombined by a grating 34

and reflected onto a *single* detector 35. The single detector is connected to a demodulator 36 to process the detected signal. (Tobias, col. 5, lines 9-25).

<u>2. There Is No Suggestion Or Motivation For The Proposed Combination Of Stafford In View Of Tobias, And The Proposed Combination Is Improper</u>

To find an invention unpatentable as being obvious in light of prior art references, there must be a suggestion or motivation to combine those references. *See Al-Site Corp. vs. VSI Intern, Inc., 174 F.3d 1308, 1323-24 (Fed. Cir. 1999).* Without a suggestion or motivation to combine the teachings of various prior art references, the invention cannot be found obvious. *See Gambro Lundia AB v. Baxter Healthcare Corp., 110 F.3d 1573, 1579 (Fed. Cir. 1997)* ("The absence of such a suggestion to combine is dispositive in an obviousness determination.").

Motivation to combine generally arises from the prior art references themselves. *Al-Site Corp., 174 F.3d at 1324.* While an express written motivation to combine prior art references is not required, the mere fact that references can be combined or modified does not render the resultant combination obvious unless prior art also suggests the desirability of the combination. *See Manual of Patent Examining Procedure (MPEP) 2143.01 (8th ed. 2004),* citing *In re Mills, 916 F.2d 680 (Fed. Cir. 1990).* Importantly, prior art must be considered <u>in its entirety,</u> including portions that would lead away from the claimed invention. *MPEP 2141.02,* citing *W.L. Gore & Associates, Inc. v. Garlock, Inc.,* 721 F.2d 1540 (Fed. Cir. 1983).

Motivation to combine may also occasionally arise from the knowledge of those with ordinary skill in the art. *Al-Site Corp., 174 F.3d at 1324.* However, the fact that the motivation to combine need not come from the prior art references does not preclude the need for actual

evidence of a suggestion to combine. Modification or combination of the prior art, even where all aspects of the claimed invention were individually known, or where the modification or combination would have been within the ordinary skill of the art, cannot render the claimed invention obvious without some objective reason to combine the teachings of the references. *See In re Kotzab, 217 F.3d 1365, 1371 (Fed. Cir. 2000)*; *M.P.E.P. Sec. 2143.01*. In particular, the level of skill in the art "cannot be relied upon to provide the suggestion to combine references." *M.P.E.P. Sec. 2143.01 at 2100-129*, citing to *Al-Site Corp.*, 174 F.3d 1308.

There exists no objective evidence on record of an express or implied suggestion or motivation to combine Stafford and Tobias. The references of Stafford and Tobias, when considered in their entirety as required by the Federal Circuit, specifically teach away from the proposed combination. Consequently, one skilled in the art would not be motivated to combine the array detectors disclosed in Tobias with the multiplexed system of Stafford to provide the claimed invention.

(a) The Prior Art References When Considered As A Whole Teach Away From The Proposed Combination

Stafford expressly teaches using a single detector and indicates that the single detector employed should be "as linear as possible over as wide a wavelength range as possible, to provide a broadband spectrometer." (Stafford, col. 5, lines 19-22). Thus, Stafford teaches toward using a single detector with a linear response, and teaches away from using an array type detector such as that disclosed in Tobias. The Examiner asserts that although Stafford prefers a detector with a highly linear response (e.g., a single detector), the teachings of Stafford could be applied to compensate for deviation from a linear response in an array of detectors. But the

Examiner provides no objective evidence in support of this assertion. Furthermore, <u>all</u> embodiments of Stafford teach using only a single detector. (See Figures 1-5). Stafford never suggests that an array of detectors would be desirable or would even work properly with the disclosed spectrometer. This is in contrast to other components of the disclosed spectrometer, where Stafford does teach that using an array of devices would be acceptable. For example, Stafford at col. 3, lines 66-67 teaches, "A DMD may consist of a linear or aerial array of micromirrors...", and at col. 4, lines 33-35 teaches "another type of SLM 90 employed in the SLM spectrometer 7 of the present invention may be a linear array of small optical fibers 92..." The fact that Stafford states that arrays of devices are acceptable for use in certain portions of the spectrometer (e.g., an array of micromirrors and an array of fibers), but does <u>not</u> state or suggest that an array of detectors would be an acceptable replacement for a single detector with a highly linear response, contradicts the Examiner's unsupported assertions of the applicability and desirability of the proposed combination.

Furthermore, Tobias *expressly teaches away from using array detectors* in these types of optical devices. The Tobias invention comprising a single detector is intended to "permit the same quality of spectral detection that is achieved by array detection, *without the need for array detection....*" (Tobias, col. 5, lines 3-5) (emphasis added). None of the embodiments of the Tobias invention implement array detectors. Tobias' disclosure of array detectors stresses that they are extremely expensive and unsuitable for mass manufacturing. (Tobias, col. 1, lines 60-67). In fact, a *stated objective* of the Tobias invention is to ***"eliminate the need for array detectors in spectroscopy,"*** by implementing an apparatus utilizing a single detector. (Tobias, col. 2, lines 5-7)(emphasis added). In addition, the Tobias invention is asserted to "[expand] spectral detection beyond the capability of array detection" using a single detector. (Tobias, col.

5, lines 5-7). Thus, Tobias teaches away from using an array of optical detectors in the manner recited in each of the independent claims.

Moreover, Tobias also *expressly teaches away from using array detectors to perform both multiplexed and concurrent detection,* as recited in each of the independent claims. Particularly, Tobias teaches array detectors are desirable in certain applications where cost is not a factor because they perform "parallel *rather than* sequential data acquisition." (Tobias, col. 4, lines 43-45)(emphasis added). By using parallel *rather than* sequential data acquisition, the array detectors can provide various advantages, such as rapid acquisition of the "complete spectrum", "enhanced signal-to-noise ratio" and elimination of "moving parts", "resulting in reduced cost and improved life and stability." (Tobias, col. 4, lines 43-50). The express goal of eliminating moving parts directly contradicts the inventions of each of the independent claims that employ individually controllable beam manipulating elements to provide both concurrent and sequential detection.

In order to provide an cost effective solution, Tobias teaches performing sequential data acquisition using a single detector, such as a "chopper wheel." (*See, e.g.*, Tobias, col. 6, lines 3-42). Thus, Tobias teaches using *either* an array of detectors for parallel detection, *or alternatively*, using a single detector and chopper wheel in a sequential detection scheme for an inexpensive solution. Tobias does not contemplate or suggest, but in fact teaches away from, using both sequential and parallel detection schemes. As the Federal Circuit cautions, prior art references must be considered <u>as a whole</u>, including portions leading away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540 (Fed. Cir. 1983). The Examiner's hindsight application of Tobias ignores the totality of the reference, which states a

primary objective of eliminating of array detectors in spectrometry and which unequivocally teaches away from using an array of detectors to perform sequential detection.

(b) The Examiner Has Provided No Objective Evidence For Of A Motivation To Combine The References

In order to support a proposed combination under §103, an Examiner must cite to objective evidence in the record. An examiner may not, because of doubt that the invention is patentable, resort to speculation, unfounded assumption or hindsight reconstruction to supply deficiencies in the factual basis for the rejection. *See In re Warner, 379 F.2d 1011, 1017, 154 USPQ 173, 177 (CCPA 1967), cert. denied, 389 U.S. 1057 (1968).* Combining prior art references without evidence of a suggestion, teaching, or motivation to combine is hindsight, and amounts to taking the inventor's disclosure as a blueprint for piecing together prior art to defeat patentability. *See In re Dembiczak, 175 F.3d 994, 999 (Fed. Cir. 1999).* The temptation to apply hindsight is particularly strong for inventions that can be easily understood, but is nevertheless impermissible and specific findings of fact relating to motivation to combine are still required. *See In re Kotzab, 217 F.3d at 1371.* Moreover, the level of skill within the art cannot be relied upon to provide motivation or suggestion for the proposed combination. *M.P.E.P. Sec. 2143.01.*

In the Final Office Action dated April 29, 2005, the Examiner states that the Tobias reference is "being relied upon for its teachings of the advantages of array detectors relative to single detectors" but that such "advantages...are not limited to the Tobias invention and are known generally to persons of ordinary skill in the art." (Final Office Action, pg. 3, April 29, 2005). The Examiner further states that "the Stafford detector uses a single detector instead of an array of detectors" but that "given the well-known advantages of array detectors for

spectroscopy," the proposed combination of Stafford and Tobias obviates the claims of the present invention. (*Id.* at pg. 5). However, the Examiner has not provided objective evidence of motivation to combine the teachings of the references. On the contrary, the *evidence on record relied upon by the Examiner expressly teaches away* from the proposed combination. Instead, the Examiner relies upon the perceived knowledge of those with ordinary skill in the art and the assumption that the proposed modification was within the ordinary skill of the art.

The Examiner cites to no objective evidence in that expressly or implicitly suggests or motivates the proposed combination. On the contrary, Stafford and Tobias suggest the undesirability of the proposed combination. Both Stafford and Tobias expressly teach away from an array of optical detectors of the present invention. In addition, Tobias teaches away from using both sequential and parallel detection schemes. Thus, one of ordinary skill in the art would not be motivated to combine the arrays of Tobias with Stafford in the suggested manner. Without an objective reason to combine the teachings of the references, combination is improper and cannot obviate the claims of the present invention, even if the combination would have been within the ordinary skill of the art. Therefore, there exists a lack of suggestion or motivation to combine the references and the proposed combination is improper.

Accordingly, for at least these reasons, the proposed combination is improper and cannot obviate the claims of the present invention. Therefore claims 1-11, 32, and 35 are patentable over Stafford in view of Tobias.

<u>3. Stafford in View of Tobias Does Not Teach All Claim Limitations of the Claimed Invention</u>

In order to establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *M.P.E.P. Sec. 2143.03*. However, even if the array of Tobias were combined with Stafford, there is no evidence that it could be used to provide both sequential and concurrent detection. In fact, the disclosure of Tobias states the contrary, i.e., that array detectors are used for parallel rather than sequential detection. (Tobias, col. 4, lines 43-45). Thus, even if the combination were made, it would not automatically provide a system that could perform both concurrent and sequential detection. The Examiner has not cited to any objective evidence in the record that the control components of Stafford could be modified to manage anything more than a single detector system, i.e., system with an array of detectors.

In response to these issues, the Examiner makes several assertions. First, the Examiner asserts that the proposed combination of Stafford and Tobias will automatically provide a system that could perform both concurrent and sequential detection since "the Stafford device already achieves concurrent and sequential detection with only a single detector." (Final Office Action, pg. 3, April 29, 2005). However, this assertion confuses the capability of the claimed invention of both concurrent and sequential detection of *each* of the multiple spectral channels using an array of optical detectors, wherein each optical detector of the array corresponds to a unique one of the spectral channels, with the teaching of Stafford to detect a *portion* of the wavelength spectrum concurrently with a single detector. In particular, the Stafford device uses a single detector to detect an individual wavelength, or alternatively to detect a combination of wavelengths concurrently, but not individually. (Stafford, col. 5, lines 24-30). In fact, the Stafford device is incapable of detecting individual wavelengths concurrently. The Stafford device requires application of a post-detection method to detect each individual wavelength

separately from the portion of the wavelength spectrum received by the single detector. Stafford describes one method, using so called Hadamard software, which operates by sequentially detecting combinations of the wavelength spectrum (such as by activating only portions of the SLM) to extract relevant information regarding each individual wavelength. (Stafford, col. 6, lines 59-67, and col. 7, lines 1-3). In other words, the Stafford device *does not detect each spectral channel concurrently, but rather detects bands of spectral channels in a sequential manner* in order to detect each spectral channel. In contrast, the claimed invention is capable of detecting *each spectral channel concurrently* as well as sequentially. Thus, the Examiner's assertion that the Stafford device already achieves concurrent and sequential detection with a single detector is misplaced.

Second, the Examiner asserts that although Stafford prefers a detector with a highly linear response (e.g., a single detector), the teachings of Stafford could be applied to compensate for deviation from a linear response in an array of detectors. In particular, the Examiner asserts that the software taught by Stafford could be readily applied to compensate an array of detectors. (Final Office Action, pg. 5, April 29, 2005). Alternately, the Examiner maintains that "an array of detectors provides additional flexibility in terms of tailoring the response of individual detectors to improve the linearity of the array as a whole to beneficially reduce the dependence on post-compensation software." (Final Office Action, pg. 6, April 29, 2005). However, as presented previously by the Appellants and noted by the Examiner, the Stafford reference refers only to compensation of "known" non-linear responses in a single detector, and not any deviation from a linear response. (Stafford, col. 7, lines 1-3; Final Office Action, pg. 4-5, April 29, 2005). Thus, there is no objective evidence that the teachings of Stafford could be readily applied to compensate an array of detectors.

In response, the Examiner asserts that the necessary compensation for an array "would not be a technological obstacle for those with ordinary skill in the art." (Final Office Action, pg. 5, April 29, 2005). Yet there is no objective evidence of record that supports these assertions. Instead, the Examiner relies upon the assumption that the proposed modification was within the ordinary skill of the art. Such broad conclusory statements regarding the teaching of multiple references, standing alone, are not "evidence." *In re Dembiczak, 175 F.3d 994, 999, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999).* Accordingly, there is no suggestion that the proposed combination of Stafford and Tobias could be used to provide both sequential and concurrent detection, and the Examiner has not cited to any objective evidence in the record that the control components of Stafford could be modified manage anything more than a single detector system.

B. Claims 18-29, 31, and 36 are Patentable over Stafford in View of Tobias and Braun

The Examiner rejected claims 18-29, 31 and 36 as unpatentable over Stafford in view of Tobias, further in view of Braun. Braun was cited for its ability to handle input signals with orthogonal polarizations. Namely, the Examiner asserted that it would be obvious to combine the array detectors disclosed in Tobias and the multiplexed system of Stafford with the orthogonal polarization disclosure of Braun to provide the claimed invention.

Appellants incorporate by reference the arguments made above with respect to the combination of Stafford and Tobias. Particularly, the combination is improper because the Examiner has failed to provide any objective evidence of record that would motivate one skilled in the art to combine the references in the described manner, or to further combine the additional Braun reference. The references specifically teach away from the proposed combination, and suggest the undesirability of such a combination. Moreover, there is no evidence that the

proposed combination teaches all of the limitations of the claimed invention, for example, using an array of detectors to perform both concurrent and sequential detection.

Accordingly, for at least these reasons, the proposed combination is improper and cannot obviate the claims of the present invention. Therefore claims 18-29, 31, and 36 are patentable over Stafford in view of Tobias, further in view of Braun.

C. *Claims 12-17 are Patentable over Stafford in View of Tobias and Saunderson*

The Examiner rejected claims 12-17 as unpatentable over Stafford in view of Tobias, further in view of Saunderson. Saunderson was cited for its disclosure of a mechanical servo system for spectrometer alignment utilizing monitor radiation. Namely, the Examiner asserted that it would be obvious to combine the array detectors disclosed in Tobias and the multiplexed system of Stafford with teaching of monitor radiation of Saunderson to provide the claimed invention.

Appellants incorporate by reference the arguments made above with respect to the combination of Stafford and Tobias. Particularly, the combination is improper because the Examiner has failed to provide any objective evidence of record that would lead one skilled in the art to combine the references in the described manner. Saunderson teaches a mechanical servo system that moves a lever 46 using a servo motor 48 and threaded block 52 to align the spectrometer. (Saunderson, col. 2, lines 65-72). In contrast, Tobias teaches the elimination of moving parts for performance considerations. Thus, the references specifically teach away from the proposed combination, and suggest the undesirability of such a combination. Moreover, it is

not clear that the proposed combination teaches all of the limitations of the claimed invention, for example, using an array of detectors to perform both concurrent and sequential detection.

Accordingly, for at least these reasons, the proposed combination is improper and cannot obviate the claims of the present invention. Therefore claims 12-17 are patentable over Stafford in view of Tobias, further in view of Saunderson.

Respectfully submitted,

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Claims Appendix

Claim 1 (previously presented)

An optical apparatus, comprising:

a) an input port, providing a multi-wavelength optical signal;
b) a wavelength-disperser that separates said multi-wavelength optical signal by wavelength into multiple spectral channels having a predetermined relative arrangement;
c) an array of beam-manipulating elements positioned to correspond with said spectral channels; and
d) an array of optical detectors, including a plurality of optical detectors each corresponding to a unique one of said spectral channels;

wherein said beam-manipulating elements are individually controllable, so as to be capable of directing spectral channels into said array of optical detectors concurrently and capable of directing spectral channels into said array of optical detectors in a time-division-multiplexed sequence.

Claim 2 (original)

The optical apparatus of claim 1 wherein said beam-manipulating elements comprise micromirrors.

Claim 3 (original)

The optical apparatus of claim 2 wherein said micromirrors comprise silicon micromachined mirrors.

Claim 4 (original)

The optical apparatus of claim 2 wherein each micromirror is pivotable about at least one axis.

Claim 5 (original)

The optical apparatus of claim 1 wherein said beam-manipulating elements comprise MEMS (micro-electro-mechanical-system) shutter-elements.

Claim 6 (original)

The optical apparatus of claim 1 wherein said beam-manipulating elements comprise liquid crystal shutter-elements.

Claim 7 (original)

The optical apparatus of claim 1 wherein said wavelength-disperser comprises an element selected from the group consisting of ruled diffraction gratings, curved diffraction gratings, holographic diffraction gratings, echelle gratings, transmission gratings, and dispersing prisms.

Claim 8 (previously presented)

The optical apparatus of claim 1 wherein said array of optical detectors comprises an element selected from the group consisting of PN photo detectors, PIN photo detectors, and avalanche photo detectors.

Claim 9 (original)

The optical apparatus of claim 1 wherein said input port comprises a fiber collimator, coupled to an input optical fiber transmitting said multi-wavelength optical signal.

Claim 10 (original)

The optical apparatus of claim 9 wherein said input optical fiber is a single mode fiber.

Claim 11 (original)

The optical apparatus of claim 1 further comprising a beam-focuser for focusing said spectral channels into corresponding focused spots that impinge onto said beam-manipulating elements.

Claim 12 (original)

The optical apparatus of claim 1 further comprising a reference signal, emerging from said input port along with said multi-wavelength optical signal, wherein said wavelength-disperser directs a reference spectral component of said reference signal to a predetermined location on a reference-position-sensing element.

Claim 13 (original)

The optical apparatus of claim 12 wherein said reference-position-sensing element comprises an element selected from the group consisting of position sensitive detectors, quadrant detectors, and split detectors.

Claim 14 (original)

The optical apparatus of claim 12 wherein said input port comprises a fiber collimator coupled to an input optical fiber, wherein said optical apparatus further comprises an optical combiner for coupling a reference light source to said input optical fiber, and wherein said input optical fiber transmits said multi-wavelength optical signal and said reference light source provides said reference signal.

Claim 15 (original)

The optical apparatus of claim 12 further comprising an alignment-adjusting element for adjusting an alignment between said spectral channels and said beam-manipulating elements.

Claim 16 (original)

The optical apparatus of claim 15 wherein said beam-manipulating elements and said reference-position-sensing element form an optical-element array, and wherein said alignment-adjusting element comprises an actuation device coupled to said optical-element array, for causing said optical-element array to move.

Claim 17 (original)

The optical apparatus of claim 15 further comprising a processing element in communication with said alignment-adjusting element and said reference-position-sensing element, wherein said processing element monitors an impinging position of said reference spectral component onto said reference-position-sensing element and provides control of said alignment-adjusting element accordingly, so as to maintain said reference spectral component at said predetermined location, thereby ensuring a requisite alignment between said spectral channels and said beam-manipulating elements.

Claim 18 (previously presented)

An optical apparatus, comprising:

a) an input port, providing a multi-wavelength optical signal;

b) a polarization-separating element that decomposes said multi-wavelength optical signal into first and second polarization components;

c) a polarization-rotating element that rotates a polarization of said second polarization component by approximately 90-degrees;

d) a wavelength-disperser that separates said first and second polarization components by wavelength respectively into first and second sets of optical beams;

e) a beam-focuser that focuses first and second sets of optical beams into corresponding focused spots;

f) an array of beam-manipulating elements positioned to correspond with said first and second sets of optical beams; and

g) at least one array of optical detectors for monitoring power associated with said first and second polarization components;

wherein said beam-manipulating elements are individually controllable, so as to be capable of directing some of said optical beams into said at least one array of optical detectors concurrently and capable of directing some of said optical beams into said at least one array of optical detectors in a time-division-multiplexed sequence.

Claim 19 (original)

The optical apparatus of claim 18 wherein said beam-manipulating elements comprise micromirrors.

Claim 20 (original)

The optical apparatus of claim 19 wherein said micromirrors comprise silicon micromachined mirrors.

Claim 21 (original)

The optical apparatus of claim 19 wherein each micromirror is pivotable about at least one axis.

Claim 22 (original)

The optical apparatus of claim 18 wherein said beam-manipulating elements comprise liquid crystal shutter-elements.

Claim 23 (original)

The optical apparatus of claim 18 wherein said beam-manipulating elements comprise MEMS shutter-elements.

Claim 24 (original)

The optical apparatus of claim 18 wherein said polarization-separating element comprises an element selected from the group consisting of polarizing beam splitters and birefringent beam displacers.

Claim 25 (original)

The optical apparatus of claim 18 wherein said polarization-rotating element comprises an element selected from the group consisting of half-wave plates, liquid crystal rotators, and Faraday rotators.

Claim 26 (original)

The optical apparatus of claim 18 wherein said wavelength-disperser comprises an element selected from the group consisting of ruled diffraction gratings, holographic diffraction gratings, echelle gratings, curved diffraction gratings, transmission gratings, and dispersing prisms.

Claim 27 (original)

The optical apparatus of claim 18 wherein said beam-focuser comprises at least one focusing lens.

Claim 28 (original)

The optical apparatus of claim 18 wherein said input port comprises a fiber collimator.

Claim 29 (previously presented)

The optical apparatus of claim 18 wherein said at least one array of optical detectors comprises a single array of optical detectors.

Claim 31 (previously presented)

The optical apparatus of claim 18 wherein said at least one array of optical detectors comprises at least one element selected from the group consisting of PN photo-detectors, PIN photo detectors, and avalanche photo detectors.

Claim 32 (previously presented)

A method of spectral power monitoring, comprising:

a) providing a multi-wavelength optical signal;

b) separating said multi-wavelength optical signal by wavelength into multiple spectral channels; and

c) selectively directing said spectral channels into an array of optical detectors, such that some of said spectral channels are capable of being received by said optical detectors concurrently and some of said spectral channels are capable of being received by said optical detectors in a time-division-multiplexed sequence.

Claim 35 (original)

The method of claim 32 wherein said step c) is carried out by way of an array of micromirrors that are individually movable.

Claim 36 (previously presented)

A method of optical spectral power monitoring, comprising:

a) providing a multi-wavelength optical signal;

b) decomposing said multi-wavelength optical signal into first and second polarization components;

c) rotating a polarization of said second polarization component by approximately 90-degrees;

d) separating said first and second polarization components by wavelength respectively into first and second sets of optical beams;

e) focusing said first and second sets of optical beams into corresponding focused spots;

f) impinging said first and second sets of optical beams onto an array of beam-manipulating elements; and

g) individually controlling said beam-manipulating elements, such that some of said optical beams are capable of being directed into at least one array of optical detectors concurrently and some of said optical beams are capable of being directed into said at least one array of optical detectors in a time-division-multiplexed sequence, whereby said at least one array of optical detectors monitors power associated with said first and second polarization components.